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AUTHOR Chaudron, Craig
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ABSTRACT

Models of the second language acquisition process have not specifically elaborated on the nature of the learner's reception and processing of target language input, a process known as "intake." The models have failed to specify the mechanisms or variables involved in intake, or to distinguish between the stages of processing input from perception to comprehension, to assimilation into an interlanguage grammar. Research and theoretical models from first-language psycholinguistics literature have been neglected. A review of recent first-language and second-language research on language processing suggests that the theory and methodology for exploring the gap between target language input and its intake by second-language learners is still in the early stages of development, but three important elements are needed for such research: (1) more control over independent variables; (2) more standardized measures contrasting in the degree and type of learner processing; and (3) more systematic development and application of a model for predicting research results. (MSE)

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Intake: On Models and Methods for Discovering Learners' Processing of Input

Craig Chaudron

Department of English as a Second Language
University of Hawaii at Manoa

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*Revised version of a paper presented at the Eighteenth Annual TESOL Convention, Houston, March 6-11, 1984.

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Craig Chaudron

Department of English as a Second Language

University of Hawaii at Manoa

Abstract

Models of the second language acquisition process have not specifically elaborated on the nature of the learner's reception and processing of target language input, a process known as "intake." They have typically failed to specify the mechanisms or variables involved in intake, or to distinguish between the stages of processing input from perception, to comprehension, to assimilation into an interlanguage grammar. Research and theoretical models from L1 psycholinguistic literature have been neglected. Recent L1 and L2 research on language processing are compared, and experimental methods for eliciting data to confirm them are discussed.

Intake: On Models and Methods for Discovering Learners' Processing of Input*

Craig Chaudron
Department of English as a Second Language
University of Hawaii at Manoa

Introduction

The concept of intake has an important status in second language research, and yet it has not been fully defined. The notion of intake has theoretical value, for it refers to the mediating process between the target language available to learners as input, and the learners' internalized set of L2 rules and strategies for second language development. This paper will survey recent research on learners' intake, concluding that second language research has inadequately explored the process of intake. Therefore, it will be argued that both theory and the research derived from it need to develop consistent, well-defined models and methods for investigating language learners' processing of input.

The Nature of Intake

The fundamental characteristic of the conception of the term "intake," which distinguishes it from "input" (within a systems analytical view of the second language learner), is that it identifies the learner as an active agent in

acquiring the target language (TL). This implicit rejection of a receptive, deterministic notion of the learner was evident in the first use of the term by Corder (1967):

> The simple fact of presenting a certain linguistic form to a learner in the classroom does not necessarily qualify it for the status of input, for the reason that input is 'what goes in' not what is <u>available</u> for going in, and we may reasonably suppose that it is the learner who controls this input, or more properly his intake. This may well be determined by the characteristics of his language acquisition mechanism... (Corder 1967:165)

Corder is in fact suggesting here that "input" may simply be a misnomer, although most researchers have retained use of the term input either for the TL surrounding the learner and available for intake, or often as a synonym for intake.

The issue for second language research is precisely what it is about the learner's "language acquisition mechanism" that determines the intake. The "characteristics" Corder mentions include, however, two different aspects whose influence on intake are probably independent. One aspect consists of the current state of the learner's knowledge of the TL, that is, the internalized interlanguage (IL), representations of rules and structures

that the learner has acquired. The second aspect involves the procedures, processes, and other psychological variables that make up the learner's cognitive apparatus, that is, the mechanisms for perception and learning.

Moreover, Faerch and Kasper (1980) make a further important distinction between intake which is simply reduced and decoded as communication, and "intake as relating to learning [which] refers only to input on the basis of which the learner forms her hypotheses about the L2 rules and tests them out subsequently (p. 64)." They claim that the latter type, intake as learning, is much more restricted than the former. Because of this distinction, there is occasionally ambiguity or confusion in the way that the notion of intake is used, depending on whether it refers to learners' immediate perception of the input, or to the eventual changes in their IL grammar.

In speaking of intake we are, in effect, referring not to a single event or product, but a complex phenomenon of information processing that involves several stages, roughly characterized as 1) the initial stages of perception of input, 2) the subsequent stages of recoding and encoding of the information into long-term memory, and 3) the series of stages by which learners fully integrate and incorporate the input in their developing grammars. Chaudron (1983a) labels this a continuum from <u>preliminary</u> intake to <u>final</u> intake, although the two ends of the continuum constitute very

different categories of cognitive activity. And as noted above, along the entire continuum the process is affected both by the learners' state of IL knowledge and the nature of the constraints on the process of language perception and comprehension.

For research to effectively investigate the nature of intake, it is essential to develop a theory of and methodological controls for the relevant variables in learners' processing of input, in particular to define the relationship between learners' IL competence and their speech processing mechanisms. The first matter considered will be the modelling of speech processing as perception and comprehension (preliminary intake), as viewed by both first and second language researchers. Second, theories of intake as learning (final intake) will be discussed. Finally, some studies illustrating methods for research on learners' processing of input will be compared.

An Information Processing Model of Speech Processing

The input available to second language learners is the raw data from which they derive both meaning and awareness of the rules and structures of the target language. Since it is likely that these learners perceive the input using the same cognitive mechanisms and processes as for first language speech perception, it is helpful to consider what native language research suggests as the major features of such mechanisms and processes.

Cole and Jakimik (1980) and Marslen-Wilson and Tyler (1980) have provided detailed arguments that proficient processing of a speech signal is a continuous interaction among features of the signal (bottom-up, or data-driven processing), and information and predictions based on all acquired rule systems (top-down, concept-driven). They propose (independently of each other, and with some differences in point of view) that although words are the main units of analysis, recognizable by their initial sounds, and processed more or less in sequence in the sentence, the listener's syntactic and semantic knowledge is constantly being drawn into working memory for use in analyzing the speech signal, which is usually too variable or deficient for adequate analysis of the phonemes or words if they were heard in isolation.

Although Massaro (1975) proposes a slightly different unit of analysis from that of Marslen-Wilson and Tyler, or Cole and Jakimik, his model (Figure 1) is essentially consistent with their proposals.

Insert Figure 1 About Here

By means of auditory feature detectors (some of which appear to be innate; cf. Jusczyk 1981), the speech signal received as neural impulses is stored temporarily in a very short-term storage (pre-perceptual auditory store, lasting about

250-300 msec), in which the signal has already been partially analyzed according to the constraints evolved in the detectors. Following this, linguistic rules and other knowledge systems are called upon from long-term memory (LTM) to interpret this filtered signal (primary recognition) and then synthesize it into phoneme-, syllable-, and word-strings. These then are stored only as long as is necessary to store an abstract meaning, following further analysis and recognition (secondary recognition), in LTM. Within a few seconds the formal structures heard are normally deleted from memory, usually after one or two spoken clauses have passed (Jarvella 1971, Jarvella and Herman 1972).

Such a model should apply as well to second language learners' processing of input (cf. the very similar proposal by Gasser 1983, and a very general model of such processing in Sajavaara 1981), although in this special case there is likely to be a different weighting of the contribution of knowledge of TL rule systems and other world knowledge, because the learners have acquired less complete and often inaccurate rule systems. As will be illustrated below, when the perceptual task requires precise analysis of the input, low proficiency second language learners are less capable of employing higher-level syntactic or semantic rules. They become very dependent on bottom-up, word for word processing.

An important factor in the operation of such a perceptual system is the degree of control exerted by the learner over the process. Some research in cognitive psychology has suggested a dual process model of cognition, involving "automatic" and "controlled" processing (Shiffrin and Schneider 1977). Roughly speaking, automatic language processing derives either from innate mechanisms for perception and analysis of human language, or from controlled processes that, through repetition, become automatized. This distinction was intimated by Selinker and Lamendella (1981), and applied by Bialystok (1982) and McLaughlin, Rossman, and McLeod (1983) in second language research. McLaughlin, et al. have argued that this distinction in effect does away with Krashen's notion of an acquisition/learning distinction (1982), in that all learning or acquisition proceeds from controlled processes to automatic processes; moreover, depending on the degree of automaticity, and the demands of specific tasks, control can be re-exercised to change or extinguish automatized behaviors.

On this account, the listener will automatically process the input according to the most deeply acquired systematic rules available, but will have to revert to controlled processing when the automatic routines fail. As first language acquisition studies have shown (Ammon and Slobin 1979, Slobin and Bever 1982), language-specific, and

thereby acquired, sentence processing strategies influence the interpretation of utterances. Since the effects of first language transfer are evident in a variety of domains (although little researched as regards the preliminary stages of intake; see Gass and Selinker 1983), second language learners will obviously need to override such acquired strategies, or procedures, by controlled processes, and gradually acquire new TL-appropriate procedures, not as replacements, but as alternatives, for their highly automatized first language procedures.

Intake as Learning and Hypothesis-Testing

Most second language researchers have been more concerned with the learner's final intake, or the ways in which learners modify and develop their IL grammar with preliminary intake, than they have been with the initial stages of perception and comprehension. The principal studies of effects of input have tended to correlate general features of input available to learners with samples of the learners' performance (e.g. Hatch 1974, Larsen-Freeman 1977, Long 1981). The many variables intervening between the presence of certain input, the perception of the input, and the internalization of new structures and rules from this intake, are difficult to examine. A few theorists have attempted to characterize this process with sometimes unclear distinctions between the input, as TL structures

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available for intake, or as the learner's preliminary intake. Such proposals have consistently involved hypothesis-testing models.

It is worthwhile quoting at length here from a rather specific proposal of this type (see also Bialystok 1978 and Schachter 1983a, b). Faerch and Kasper (1980) are evidently referring to some preliminary intake, or form/rule perceived by the learner, which, for reasons which they do not specify, is focussed on as a candidate for an interlanguage rule.

> The main processes in IL rule formation are the formation and testing out of hypotheses about a specific L2 rule. A schematic overview of these processes is contained in [Figure 2]. In initial <u>hypothesis formation</u>, the intake constitutes the material on which the learner bases the formation of a hypothetical rule. This hypothetical rule is subsequently checked for its validity by being used in communication or, in formal learning settings, in exercises, etc. (<u>hypothesis testing</u>). While thus the overt intention of the learner's using a particular hypothetical rule may be to communicate, its occurrence in her output functions simultaneously as a test as to its validity, ie as a learning device. Likewise, the interlocutor's intention in reacting to the

learner's output will usually be to communicate; however, the taken-in part of the interlocutor's input (intake-f) also serves as feedback as a result of which the hypothesis under test is either confirmed or rejected. In the case of positive feedback leading to hypothesis confirmation, the hypothetical rule changes its status to become a fixed rule of the IL system. Negative feedback leading to hypothesis rejection, on the other hand, induces the learner to either look for new intake or to use the feedback to form a revised hypothesis. In the latter case, intake-f functions as intake. The procedure of hypothesis formation and testing is repeated until the learner's hypothesis is confirmed and gets stored as a fixed rule. (Faerch and Kasper 1980:65-67).

Insert Figure 2 about here

Since the intake in this model is a critical factor for both hypothesis formation and hypothesis confirmation, it seems all the more imperative to understand by what processes and under what constraints the original intake was perceived and selected. This same point is applicable to the very influential "Input Hypothesis" of Krashen (1982),

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which places a similar responsibility on the learner's speech processing system. As is seen in the following quote, the learner's development in the second language is contingent upon his/her processing the meaning of an input message, despite the fact that it contains a form that is beyond the learner's competence:

> The input hypothesis makes the following claim: a necessary (but not sufficient) condition to move from stage i to stage $i + 1$ is that the acquirer understand input that contains $i + 1$, where "understand" means that the acquirer is focussed on the meaning and not the form of the message.
>
> We acquire, in other words, only when we understand language that contains structure that is "a little beyond" where we are now. How is this possible? How can we understand language that contains structures that we have not yet acquired? The answer to this apparent paradox is that we use more than our linguistic competence to help us understand. (1982:21)

Krashen proposes that the learner makes sense of input by use of extra-linguistic knowledge, which means that pragmatic or other inferential procedures based on world knowledge and situational clues are called upon; this is top-down processing. It is not clear from this claim,

however, by what mechanisms the learner is able to perceive, or filter out the basic meaning from potentially misleading information in the input, especially in what ways the learner's linguistic competence plays a part in this process.

Krashen's recent specification (1983) of the process by which the $i + 1$ in input would become an internalized rule (final intake) looks very much like the proposal of Faerch and Kasper above. This explicit clarification of the Input Hypothesis, seen in the following quote, is Krashen's clearest statement to date of the mechanism for incorporating input into an interlanguage grammar:

> For acquisition to occur, acquirers need to notice a difference between their current level of competence i, and the new structure or form presented by either input or the creative construction system....
>
> If the comparison of i and $i + 1$ shows a gap, the $i + 1$ form becomes a candidate for acquisition. Whether it actually survives depends on whether it turns up in the input again: hence the second input box in [Figure 3]. If it does turn up with some minimum frequency, it can be confirmed and acquired. If it does not turn up, it is a 'transitional form' and will eventually be discarded. Before this happens, however, the

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transitional form may usefully serve as i (1983:139).

Insert Figure 3 about here

There are several observations worth making about this proposal. For one, Krashen is proposing that the "preliminary" intake of input forms includes a comparison of a known form with an unknown one. How this comparison is conducted involves the mechanisms of perception of the input, which are presumably represented by the arrows in Figure 3. But Krashen has not specified these mechanisms or processes. The L1 literature suggests that the unknown form in the input is probably not so unfamiliar to the learner, since the perception of the input will likely be filtered by acquired, though automatic, interpretive procedures, before any hypothesis-testing comparisons are made. The learner's IL thus has two shots at the input.

Secondly, note that the persistence of the $i + 1$ in the learner's transitional grammar will depend finally, he claims, on the frequency of recurrence of the form in input. Although Krashen has never stated it thus, it seems that an important principle of psychological learning theory has been invoked here, namely, that of the positive effect of repetition and rehearsal for the encoding of information in memory (see Nelson 1977, Glanzer 1982:80-85). Whether this

is in fact the primary way in which learners develop new rule systems is of course unknown, but it is worth pointing out that McLaughlin's critcisms of Krashen's various formulations of the Input Hypothesis (most recently in McLaughlin, et al. 1983) are in accord with the above inference: a controlled process, such as a comparison between forms, is repeated, and automatized by means of the repetition. Krashen differs, perhaps, in that in his view it may take few repetitions for the form to be adopted as a transitional form. This is a claim in need of empirical validation.

A third comment is that in order to test this elaborated Input Hypothesis, we must be able to identify what constitutes i and $i \pm 1$, a test not made easier by the fact that Krashen has simultaneously proposed that the "transitional" $i \pm 1$, a tentative learner's hypothesis over several trials, will not necessarily correspond to any externally determined $i \pm 1$, either in input, or in any natural order of acquisition (1983:141-142). The researcher is left very much in the dark, for apparently anything could serve as a transitional $i \pm 1$.

A fourth point to note is that while Krashen has primarily been referring to syntactic rules, we must presume that the Input Hypothesis is generalizable to all linguistic systems to be acquired, namely, to phonology, semantics, pragmatics, discourse, and so on.

Following from this presumption is a fifth point: the various rule systems, whether at an i level or an $i \pm 1$, would presumably be operating and interacting all at one time, giving rise to systemic adjustments and interactions and thereby clouding the otherwise neat results one might discover for a particular rule system.

It is not clear whether Krashen has developed this rather simplistic model of input processing to make it more easily testable, or whether he believes that the entire process can be reduced to many such comparative operations. Although he has proposed (1983) further points relating to the possibility of native language transfer in eventual, final intake, which cannot be dealt with here, the role of the i stage (or other information) in determining which $i \pm 1$'s are actually perceived is probably one of the critical elements in need of elaboration in the theory.

Testing the Models

There are two principal questions pertinent to the testing of models of second language intake. First, can we use them to generate specific research hypotheses regarding the interaction between so many competing rule systems? At the present time, very few such hypotheses have been tested. And second, if we can test the models, do we have the appropriate methodologies available to carry out the research?

Regarding the first question, the major complications ponted out above are 1) that it is difficult to specify the presumed i or $i \pm 1$ within an IL subsystem, 2) we remain unenlightened about the learner's manner of comparing the $i \pm 1$ to the i or to the input, and 3) there are complex interactions among the IL rule systems, the learner's attention and control over them, and other individual variables, making the prediction of effects of factors extremely difficult. In order to develop more specific knowledge or hypotheses about IL subsystems and their interactions during learners' processing of input, we need more systematic research that controls for the various factors and their possible interactions.

In regard to the second question, it is evident that we need to consider the extent to which different research measures and procedures influence the interaction between input and learners' capacities for processing it. Each measure or procedure is likely to allow different intervening factors to affect learners' perception or processing.

Figure 4 (from Chaudron 1983b) shows a number of tasks which can be used to determine listeners' response to input. These can be viewed as differing from one another primarily along two dimensions of response measures: 1) the amount of encoding or recoding of the input into other forms, whether motor behavior or language, and 2) the degree of

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comprehension required, that is, the level of grammatical abstraction from the input that is expected of the learner.

Insert Figure 4 About Here

These dimensions have implications for both the time involved and the stages of intake processing. Briefly, along both dimensions, towards the right on production and towards the bottom on comprehension, more time is required for the task. It is important to realize that the more time available, the more opportunity the learner/listener has to engage higher level, less automatized knowledge sources that would confound the analysis of early stages of intake processing.

In regard to the degree of input processing along the continuum of stages (from preliminary to final), either the further left or to the top of Figure 4, the more the task is presumed to involve only the first stages of abstraction from the input data. Thus, on the production dimension, non-verbal responses involve a match between input and an image in short term memory (STM), which can take as little as one-half second. Oral responses involve such a match, but additionally require further recoding to a productive mode, presumably involving the same features (if production and comprehension work out of the same source), so that there is some potential for interference from

inappropriately automatized production routines, and the actual perceptual competence of the listener would be obscured. Similarly, written responses normally require another step in recoding, through an aural representation to a graphic one. On the comprehension dimension, signal detection again involves only a match in STM, while a categorization task and other structural analyses require additional steps in analysis in LTM. Most psycholinguists would consider grammatical judgments to almost necessarily engage LTM and controlled processes, since only certain syntagmatic associations are typically automatized; the perceptual system would be inefficient, in fact, if it bypassed the control over incoming messages that is required for higher levels of language analysis.

There have been far too few studies whose purpose was to investigate the efficiency and reliability of these tasks in determining learners' intake. Comparisons of learners processing the same input using different task measures, or experimentally manipulated input variables using the same task, are relatively few and far between. For example, Hyltenstam (1983) attempted to use different tasks -- grammatical judgments, imitation, and elicited oral production -- as measures of learners' competence with relative clause pronoun copies, but his comparison is incomplete. He found, in fact, great variability among subjects in their relative competence across different

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tasks. Tarone (1984) found learners to be less accurate in their grammatical judgments about the items than in productive use of articles and direct objects, but more accurate on third singular -s. She attributes this to possible discourse-related constraints on direct object and article use that the learners could not make use of in the judgment task. These learners' free production evidently could make use of automatized procedures with the forms which they could not control when forced to make decisions about the forms in isolation. In this case, however, it should be noted that not only the tasks, but the stimulus materials were different. For further discussion on studies comparing grammatical judgments with other tasks, see Chaudron (1983c). Finally, Hulstijn and Hulstijn (1984) controlled for the amount of time and type of attention required of L2 learners of Dutch, in a study demanding recall of aurally presented texts. While they were principally concerned with the subjects' productive control of certain grammatical rules, the learners' ability to recall the information was significantly better when they were not paying attention to correct grammatical production. However, it is not possible to tell in Hulstijn and Hulstijn's results whether the loss of information was due to production constraints or to constraints during the processing/intake of the texts, since the subjects were aware of the condition before hearing the passage. This is

a typical case where further research is needed to determine whether a prior set for attention to form would inhibit learners' processing of meaning.

Studies of the preliminary stages of intake have used reaction time (Lehtonen and Sajavaara 1983), elicited imitation (Naiman 1974, Swain, Dumas and Naiman 1974, Markman, Spilka and Tucker 1975), partial dictation and list recall (Harris 1969, Johansson 1973, Meara 1980, Spitze and Fischer 1981, Henrichsen 1983, Chaudron 1983b), aural cloze (Tommola 1979, Henning, Gary and Gary 1981, Chaudron 1983b), and the click-monitoring paradigm of L1 studies (Gass 1979). These measures, while still confounded by possible production errors, have been used rather effectively to show that less competent learners perform less well, or process the aural input provided them in a rote fashion, failing to process the syntactic or semantic forms. For instance, Spitze and Fischer (1981) found intermediate and advanced learners differing in their serial recall of semantically or syntactically related items, where the lower level subjects recalled them more as unrelated lists. Meara (1980) had similar results. Henrichsen (1983) found ESL learners at two levels unable to recall reduced (Sandhi-variation) forms, while the more advanced level could recall the items in their full forms. Thus, their short term auditory storage was not as deficient as their syntactic reconstruction capacity based on long-term storage.

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Finally, Lehtonen and Sajaniara (1983) used reaction time as a measure of comprehension when subjects made grammatical judgments. Non-native speakers showed much greater reliance on surface form than native speakers, with the latter group often responding more slowly, presumably due to potential semantic ambiguities that engaged their attention to form. Their study suffers, however, from poor control over the syntactic content of the stimulus sentences, so it is difficult to conclude what led to certain of their latency effects.

The important point in interpreting such research results is that, given the different characteristics of processing tasks on at least two dimensions, and the interactive nature of more complex processing, one should expect to find different "grammars" emerging with different elicitation measures. The above findings are then actually very encouraging. As Bialystok (1982) has argued, one would predict that not only different knowledge representations of grammar would lead to different results, but that the task measure will also demand different degrees of accessibility of that knowledge.

Conclusion

The theory and methodology for exploring the gap between TL input and its intake by second language learners is still in early stages of development. It seems more and

more warranted to pursue research along the lines of the last few studies mentioned. However, three important guidelines for such research should be noted.

First we must exert more control over the independent variables under investigation. If differentiation in learners' representation of knowledge is the target question, we must use learners with quite specific language or educational backgrounds and known proficiencies in some area of the L2, before testing them with specific input measures. Or if differentiation in accessibility of type of linguistic rule is at issue, we must better control the linguistic context of the stimulus material and then maintain uniform task measures. In a similar manner, control of other variables, such as affective or personality differences among learners, is always warranted.

Second, we must develop more standardized measures that contrast in the degree and type of processing required of the learner, in order to achieve greater comparability across studies. This involves a more concerted effort on the part of all researchers to adopt prior researchers' methods for replication of findings with different populations or independent variables, or else to more carefully construct and evaluate the measures they choose to develop.

Third, we must attempt more systematically to develop and apply a model of intake processing that can be used to

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predict the results of our studies. This means that the existing portions of theories of intake such as those of Faerch and Kasper, Krashen, or of L1 researchers, must be put to experimental tests with L2 learners, thereby gradually shaping the specifications of the theories.

The alternative to adopting more rigourous methods will be a continous fumbling about in the dark, a failing to systematize and interpret the variability that appears in the elicitation of learners' interlanguage. But with care and cooperative research, we may begin to uncover the mechanisms and processes of the L2 learner's receptive competence.

Notes

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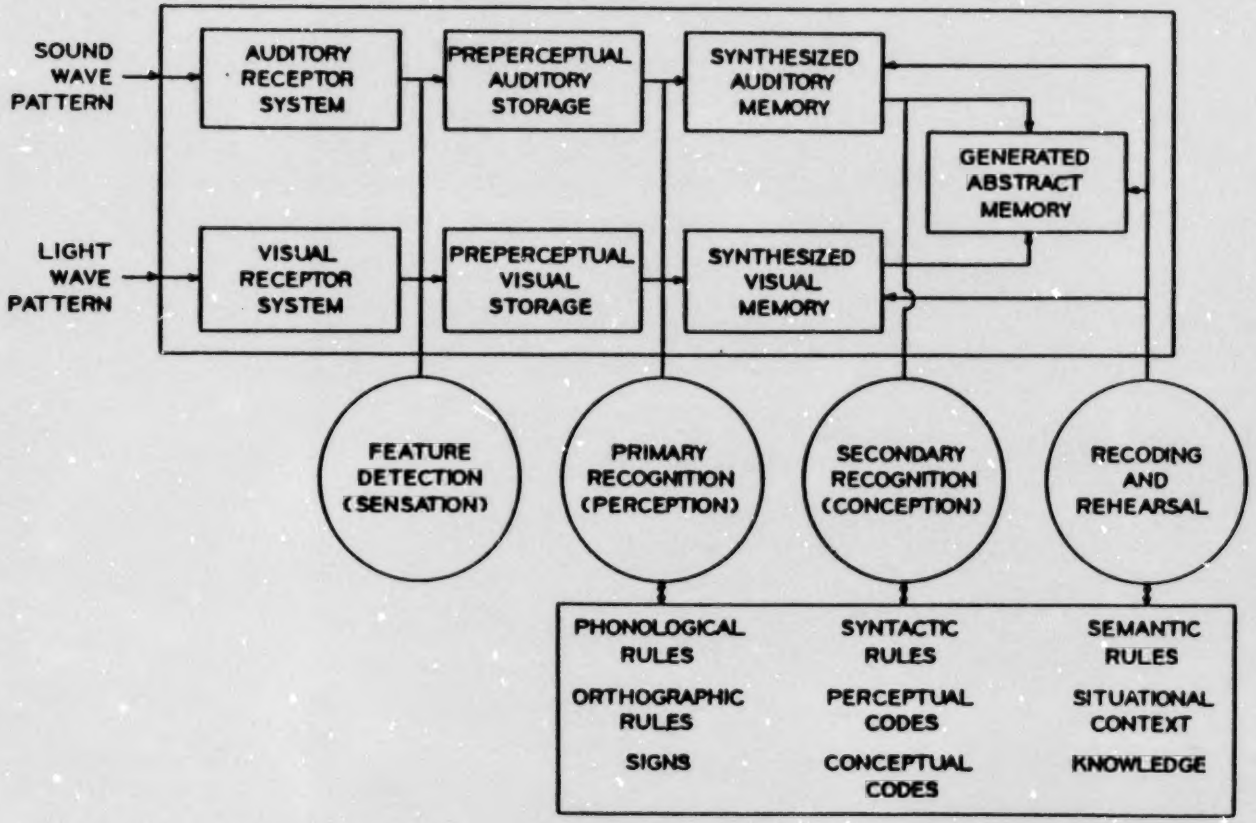


Figure 1 Flow diagram of the temporal course of auditory and visual information processing.

(From Massaro 1975)

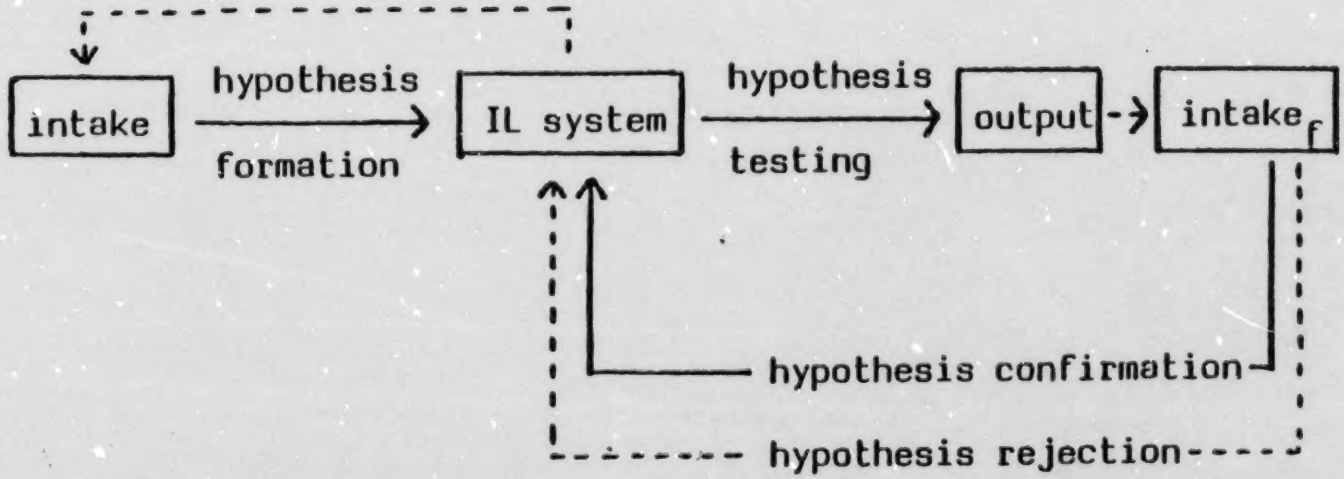
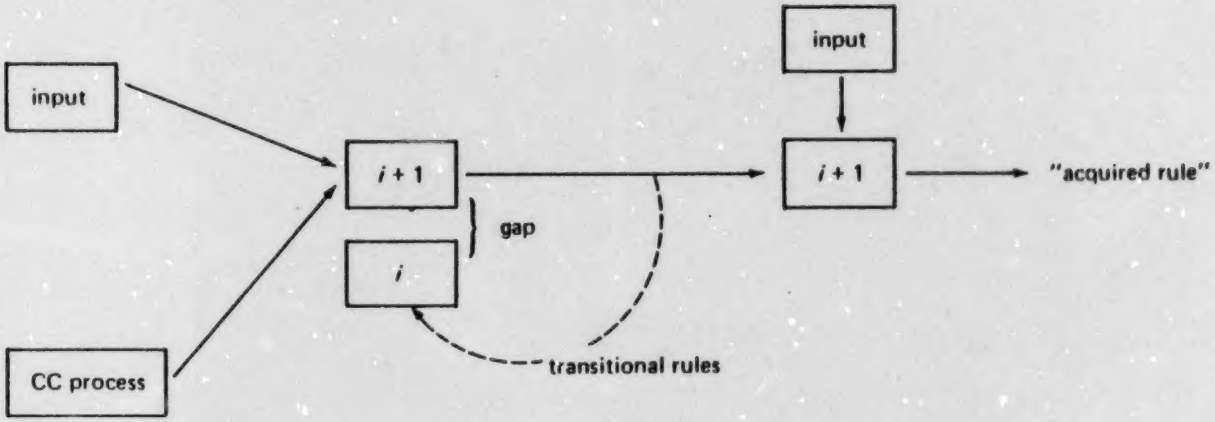


Figure 2 IL rule formation

(From Faerch and Kasper 1980)



(see text for explanation)
CC: creative construction process
i: current rule (already acquired)
i + 1: candidate for acquisition

Figure 3 Internal Process in Language Acquisition (Krashen-Andersen Schema)

(From Krashen 1983)

(from Chaudron 1983b)

Figure 4

Dimensions of Tasks Responding to Input